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Translated: 01:56:10 JST 09/30/2006

Dictionary: Last updated 09/12/2008 / Priority: 1. Mechanical engineering

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## CLAIM + DETAILED DESCRIPTION

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**[Claim(s)]**

[Claim 1] So that predetermined rolling-up tension may be given to the above-mentioned wire rod pulled out from the turntable in which the supply drum around which the revolution in right reverse both directions was enabled focusing on the vertical axis, and the wire rod was wound is laid, and the above-mentioned supply drum The supply apparatus which has the rewinding apparatus which renews the above-mentioned wire rod which the reverse direction was made to rotate the braking system and the above-mentioned supply drum which brake a revolution of the above-mentioned supply drum, and was once sent out to the above-mentioned supply drum while giving predetermined rewinding tension, The coil winding machine which has the coil former which rolls round the above-mentioned wire rod from the above-mentioned supply drum, and forms winding wire while rotating focusing on a vertical axis, And the bobbin machine of the rest electromagnetic-induction electrical machinery equipped with at least one side of the drum rise-and-fall apparatus which goes up and down the above-mentioned supply drum so that the above-mentioned wire rod rolled round by the above-mentioned coil former may become almost level from the above-mentioned supply drum between the above-mentioned supply drum and the above-mentioned coil former, and the coil former rise-and-fall apparatus which goes up and down the above-mentioned coil former.

[Claim 2] [ coil former ] so that a wire rod may go across a wire rod from the disc-like coil section of 1 which winds around the radial direction of coil former in piles, and is formed in it, and the coil section of the above 1 It is what carries out, and adjoins the coil section of the above 1, rolls round so that another disc-like coil section which wound around the radial direction of coil former in piles, and was formed in it may be formed, and forms winding wire. While forming the pre-processing apparatus which performs bending for passages so that it can cross to another coil section into which a wire rod adjoins from the coil section of the above 1 between a supply apparatus and a coil winding machine Form both drum rise-and-fall

apparatus and coil former rise-and-fall apparatus, or a pre-processing apparatus rise-and-fall means of a drum rise-and-fall apparatus and a coil former rise-and-fall apparatus to reach on the other hand at least, and to go up and down the processing apparatus before the above is established. The bobbin machine of the rest electromagnetic-induction electrical machinery according to claim 1 characterized by enabling it to level mostly the wire rod which passes the processing apparatus before the above from a supply drum, and is rolled round by coil former between a supply drum and coil former.

[Claim 3] After determining the location on the wire rod which the pre-processing apparatus should once form a disc-like coil section, and should prepare the bending part for passages, The bobbin machine of the rest electromagnetic-induction electrical machinery according to claim 2 characterized by being what can carry out bending for passages to the location on the prescribed length rewinding above-mentioned wire rod with a rewinding apparatus.

[Claim 4] [ a braking system ] By giving the braking torque for which it asked from the predetermined rolling-up tension which should be given to a wire rod when rolling round from a supply drum to coil former, and the diameter of a volume of the wire rod currently wound around the supply drum to a turntable The bobbin machine of the rest electromagnetic-induction electrical machinery according to claim 2 characterized by being what controls rolling-up tension to a predetermined value.

[Claim 5] [ a rewinding apparatus ] By [ which asked from the predetermined rewinding tension which should be given to a wire rod when rewinding a wire rod to a supply drum, and the diameter of a volume of the wire rod currently wound around the supply drum ] rewinding and giving torque to a turntable The bobbin machine of the rest electromagnetic-induction electrical machinery according to claim 2 characterized by being what controls rewinding tension to a predetermined value.

[Claim 6] As for a supply apparatus, a turntable can also receive plurality. In order to perform dislocation which replaces the mutual location of the radial direction to the coil former when rolling round each wire rod from the supply drum laid in the pre-processing apparatus by each above-mentioned turntable to coil former The bobbin machine of the rest electromagnetic-induction electrical machinery according to claim 2 characterized by forming the guide apparatus which replaces and guides a location in the direction of rolling up of the above-mentioned wire rod, and the right-angled direction.

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#### [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to amelioration of the bobbin machine used for manufacture of rest electromagnetic-induction electrical machinery, such as a potential

transformer.

[0002]

[Description of the Prior Art] Drawing 13 is the side elevation showing the bobbin machine of the conventional potential transformer shown, for example in JP,S55-102218,A. In drawing, a pedestal 11 is installed in the floor F of works, and the circular turntable 12 is rotatably supported focusing on the vertical axis on this pedestal 11. The cylindrical coil former 13 is being fixed to the top face of a turntable 12 in same mind. The reduction gear 14 was formed in the underside of the turntable 12 in same mind, and the pinion 16 driven by the motor 15 installed in the pedestal 11 has got into gear.

[0003] And as coil former 13 is surrounded, the rise-and-fall apparatus 18 is installed in Floor F. The supply drum 20 is rotatably supported focusing on the vertical axis by the rise-and-fall apparatus 18 on the ramp 19 which it goes up and down according to a pantagraph device in the direction of arrow-head A of drawing which is the perpendicular direction, maintaining a horizontal position. Moreover, the brake 21 which gives a tension to the wire rod W rolled round by coil former 13 is formed between the supply drum 20 and coil former 13.

[0004] Coil former 13 is rotated through a turntable 12 by a motor 15, the wire rod W wound around the supply drum 20 is rolled round, and the cylindrical winding wire 25 is formed. At this time, the wire rod W which carries out rise-and-fall control of the ramp 19 with the control device which is synchronized with a revolution of coil former 13 and illustrated, passes a brake 21, and is rolled round by coil former 13 maintains an almost level position.

[0005]

[Problem to be solved by the invention] Since the conventional bobbin machine was constituted as mentioned above, there were the following troubles.

(1) Since the height on a ramp 19 is being uniformly fixed for both the supply drum 20 and the brake 21, when a wire rod W is rolled round from the supply drum 20, the path line of a wire rod W bends between the supply drum 20 and a brake 21. For example, it became drawing 12 like WB shown with an alternate long and short dash line, when it wound around coil former 13, it bent, and there was a case where a peculiarity remained sticking and changing. In order to prevent this, spacing of the supply drum 20 and a brake 21 must be vacated greatly, but the establishment tooth space of a bobbin machine becomes large in this case.

(2) Since frictional force was given to the wire rod W by the brake 21, there was a possibility of doing breakage to a wire rod, especially the wire rod by which the paper streamer volume insulation process was carried out.

[0006] (3) Since there was no apparatus which gives tension to a wire rod when rewinding a wire rod to the supply drum 20, when rewinding the wire rod W rolled round by coil former 13 to the supply drum 20, the wire rod loosened, and there was a possibility that a wire rod might change or twine.

(4) In the winding wire which winds a wire rod W two or more times as overlaps with the radial direction of coil former 13, and forms the disc-like section coil one by one When crossing to the following section coil from the section coil of 1, only the passage cost performed bending for passages (henceforth S bending) which processes a wire rod W in a completely different class, but since there is no suitable apparatus which performs this and manual operation was performing, working capacity was bad.

(5) There was no suitable dislocation apparatus which transposes the wire rod pulled out from two or more supply drums 20, and is supplied to coil former 13.

[0007] This invention solves the above troubles, can make an establishment tooth space small, does not have a possibility of doing breakage to a wire rod, and aims at obtaining the bobbin machine of the rest electromagnetic-induction electrical machinery which can improve dependability. Furthermore, when crossing to another section coil from the section coil of 1, only the passage cost can perform bending for passages which processes a wire rod in a completely different class. Or in order to transpose the wire rod \*\*\*\*\*\*(ed) by two or more supply drums, while replacing the mutual location, being able to supply coil former and working capacity's improving, it aims at obtaining the bobbin machine of the rest electromagnetic-induction electrical machinery which can manufacture the winding wire where quality was stabilized.

[0008]

[Means for solving problem] In order to attain the above-mentioned object, [ the bobbin machine of the rest electromagnetic-induction electrical machinery of this invention ] So that predetermined rolling-up tension may be given to the turntable in which the supply drum around which the revolution in right reverse both directions was enabled focusing on the vertical axis, and the wire rod was wound is laid, and the wire rod pulled out from a supply drum The supply apparatus which has the rewinding apparatus which renews the wire rod which the reverse direction was made to rotate the braking system and supply drum which brake a revolution of a supply drum, and was once sent out to a supply drum while giving predetermined rewinding tension, The coil winding machine which has the coil former which rolls round a wire rod from a supply drum and forms winding wire while rotating focusing on a vertical axis, And it has at least one side of the drum rise-and-fall apparatus which goes up and down a supply drum so that the wire rod rolled round by coil former may become almost level from a supply drum between a supply drum and coil former, and the coil former rise-and-fall apparatus which goes up and down coil former. Since the wire rod rolled round by coil former becomes almost level from a supply drum between a supply drum and coil former, it bends, even if it shortens distance of a supply drum and coil former, and a peculiarity does not arise, and the establishment tooth space of an apparatus can be made small. Moreover, since predetermined rolling-up tension is given to the wire rod pulled out from a supply drum by a

braking system, there is also no possibility of damaging a wire rod, especially the wire rod by which the paper streamer volume insulation was carried out. Furthermore, since the once sent-out wire rod is rewound giving predetermined rewinding tension, the deviation of the wire rod when not slackening and changing during rewinding and rolling round again can be prevented. [0009] and [ coil former ] so that a wire rod may go across a wire rod from the disc-like coil section of 1 which winds around the radial direction of coil former in piles, and is formed in it, and the coil section of 1 It is what carries out, and adjoins the coil section of 1, rolls round so that another disc-like coil section which wound around the radial direction of coil former in piles, and was formed in it may be formed, and forms winding wire. While forming the pre-processing apparatus which performs bending for passages so that it can cross to another coil section into which a wire rod adjoins from the coil section of 1 between a supply apparatus and a coil winding machine Form both drum rise-and-fall apparatus and coil former rise-and-fall apparatus, or a pre-processing apparatus rise-and-fall means of a drum rise-and-fall apparatus and a coil former rise-and-fall apparatus to reach on the other hand at least, and to go up and down a pre-processing apparatus is established. It is characterized by enabling it to level mostly the wire rod which passes a pre-processing apparatus from a supply drum, and is rolled round by coil former between a supply drum and coil former. Bending for passages crossed to another coil section which adjoins from the coil section of 1 with a pre-processing apparatus can be performed by machine.

[0010] Furthermore, it is characterized by a pre-processing apparatus being what can carry out bending for passages to the location on a prescribed length rewinding wire rod with a rewinding apparatus, after determining the location on the wire rod which should once form a disc-like coil section and should prepare the bending part for passages. Without a wire rod slackening and changing at the time of rewinding, since it rewinds by predetermined rewinding tension, when bending for passages is carried out and it rolls round again, there is also no possibility that the location of the bending part for passages may shift.

[0011] Moreover, a braking system is characterized by being what rolls round by giving the braking torque for which it asked from the predetermined rolling-up tension which should be given to a wire rod, and the diameter of a volume of the wire rod currently wound around the supply drum to a turntable, and controls tension to a predetermined value, when rolling round from a supply drum to coil former. Since braking torque is given and rolled round on a turntable and tension is made into a predetermined value, there is no possibility of damaging a wire rod.

[0012] [ and a rewinding apparatus ] When rewinding a wire rod to a supply drum, it is characterized by being what rewinds by [ which asked from the predetermined rewinding tension which should be given to a wire rod, and the diameter of a volume of the wire rod currently wound around the supply drum ] rewinding and giving torque to a turntable, and controls tension to a predetermined value. Without a wire rod slackening and changing at the

time of rewinding, since it rewinds by predetermined rewinding tension, when bending for passages is carried out and it rolls round again, there is also no possibility that the location of the bending part for passages may shift.

[0013] Furthermore, as for a supply apparatus, a turntable can also receive plurality. In order to perform dislocation which replaces the mutual location of the radial direction to the coil former when rolling round each wire rod from the supply drum laid in the pre-processing apparatus by each turntable to coil former, it is characterized by forming the guide apparatus which replaces and guides a location in the direction of rolling up of a wire rod, and the right-angled direction. A mutual location is replaced in the direction of a wire rod's rolling up of the wire rod from two or more supply drums, and the right-angled direction, and it enables it to transpose.

[0014]

[Mode for carrying out the invention] The side elevation in which form 1. drawing 1 of operation - drawing 12 show one form of implementation of this invention, and drawing 1 shows the architecture of a bobbin machine, and drawing 2 are top views. Drawing 3 is the top view showing the detail of the pre-processing apparatus part of winding wire, a sectional view [ in / in drawing 4 / cross-sectional IV-IV of drawing 3 ], and a sectional view [ in / in drawing 5 / cross-sectional V-V of drawing 3 ]. The explanatory view for description of a supply apparatus of operation and drawing 7 are the same, and drawing 6 is an explanatory view for description of a supply apparatus of operation. Drawing 8 is the elements on larger scale of a pre-processing apparatus.

[0015] The expanded sectional view of a coil-winding-machine part [ in / the pre-processing apparatus in the condition that drawing 9 transposed the wire rod and the top view of a coil-winding-machine part, and drawing 10 can be set in the partial sectional view of the coil former part of drawing 9 , and / in drawing 11 / cross-sectional XI-XI of drawing 9 ], and drawing 12 are the sectional views in cross-sectional XII-XII in drawing 9 .

[0016] A bobbin machine is divided roughly into a bench 30, the supply apparatus 40, a coil winding machine 70, and the pre-processing apparatus 100 as shown in drawing 1 and drawing 2 . The bench 30 is formed from Floor F between the supply apparatus 40 and the coil winding machine 70 like drawing 1 at predetermined height, for example, height of 0.8m, and an operator works on this bench 30.

[0017] The supply apparatus 40 consists of a rise-and-fall apparatus 41, a drum drive unit 51, and a horizontal position detection apparatus 61. First, the rise-and-fall apparatus 41 is explained. The ramp 44 shown at the rise-and-fall guide 43 is formed inside the frame 42 formed in section steel as shown in drawing. It goes up and down a ramp 44 to the sliding direction of drawing 1 which is the perpendicular direction with the ramp screw thread 46 rotated by the ramp motor 45.

[0018] The drum drive unit 51 is formed on the ramp 44. As for the drum drive unit 51, the main

shaft 52 supported rotatably is formed in the ramp 44 through bearing 53. The turntable 54 which puts the supply drum 20 on the upper part edge of a main shaft 52 adheres to, and it rotates with a main shaft 52. The rotation motor 56 in which right counterrotation with a brake is possible is combined with a main shaft 52 through the powder clutch 55, and a main shaft 52 is rotated.

[0019] In addition, with the form of this operation, the rise-and-fall apparatus 41 which goes up and down the turntable 54 supported possible [ a revolution of the supply drum 20 ] and this turntable 54 and which goes up and down is formed 2 sets respectively. The supply drum 20 is fixed namely, laid, and when a wire rod W1 and W2 (the wire rod W1 of these plurality and W2 may be hereafter called a wire rod W suitably) are pulled out from the supply drum 20 by each turntable 54, on it, it rotates like the arrow heads B and C of drawing 2 . In the form of this operation, a wire rod W is the paper-rolled flat type copper wire around which the paper streamer was wound.

[0020] Moreover, on a ramp 44, the roller 59 supported with the actuator 57 by the roller support shaft 58 by which rotation actuation is carried out is formed. When it is pressing down the wire rod W wound around the supply drum 20 as a roller 59 is rotating like the arrow heads D and E of drawing 2 , and the tension of a wire rod W is lost, a wire rod W prevents slipping down below and being involved.

[0021] A roller 59 is made to contact the wire rod W currently wound around the supply drum 20, the revolution variation-rate detector 60 to which the rotation angle of the roller support shaft 58 was attached by the roller support shaft 58 detects, and the wound diameter of the wire rod W currently wound around the pride ram 20 is detected. And the tension which changes the associative strength of the powder clutch 55 and is applied to a wire rod W is controlled.

[0022] Two rotary rollers 64 are formed in the rotary arm 63 which was supported free [ rotation on a shaft 62 ] as for the horizontal position detection apparatus 61 (also see the drawing). And the rotary roller 64 contacts a wire rod W1 and the field of the upper and lower sides of W2, follows in footsteps of change of a wire rod W1 and the height of W2, and is gone up and down. Moreover, three sensors 65, 66, and 67 by which at least a wire rod W1, the horizontal position of W2, and facing up detect at least facing down corresponding to the rotation location of the rotary arm 63, respectively are formed.

[0023] A coil winding machine 70 has the coil former rise-and-fall apparatus 71 and the coil former drive unit 78. The coil former rise-and-fall apparatus 71 is seen from the upper part like drawing 2 , and the L form frame 72 of the L form is being fixed to Floor F for the configuration of the side face by the shape of KO. The rise-and-fall screw thread 74 by which a guide 73 is perpendicularly fixed to the L form frame 72, is arranged in the back (method of the right of drawing 1 ), and right counterrotation actuation is carried out like the arrow head P of drawing

1 by the rise-and-fall motor 76 is formed. Numerical control of the location of the sliding direction which detects the engine speed of the rise-and-fall screw thread 74 with the encoder 75 of the upper part, and determines the location of the perpendicular direction of the below-mentioned ramp 77 is performed.

[0024] The coil former drive unit 78 is carried in the coil former rise-and-fall apparatus 71. The ramp 77 is supported by the guide 73 possible [ sliding of a sliding direction ] in the cantilever. And a ramp 77 is screwed in the rise-and-fall screw thread 74, and it goes up and down it in the perpendicular direction like the arrow head Q of drawing 1 by the rise-and-fall motor 76. On the ramp 77, the winding wire drive unit 78 which has the servo-motor 80 which rotates the rotary table 79 and this rotary table 79 in right reverse both directions is formed. Coil former 81 is laid on the rotary table 79.

[0025] Next, the architecture of the pre-processing apparatus 100 is explained, mainly referring to drawing 3 and drawing 4 . A frame 101 adheres to on a bench 30 (see drawing 1 ), two level rollers 103 individually supported by the cylinder 102 possible [ the upper and lower sides ] are formed, and the wire rod W1 and W2 which are pulled out from the supply drum 20 move in an it top, respectively (drawing 3, drawing 4 ). Moreover, to the entrance side whose wire rod W goes into S bending apparatus 111 (after-mentioned) at a frame 101, the vertical roller 105 is formed in an outlet side, and the vertical roller 104 regulates the location on the level surface respectively on both sides of a wire rod W1 and a wire rod W2 in between.

[0026] Two S bending apparatus 111 are formed corresponding to a wire rod W1 and W2. S bending apparatus 111 has the frame 114 which is guided at the infestation guide 112, moves in the direction which is horizontal and intersects perpendicularly with a wire rod W1 and the direction of a drawer of W2 in the actuation cylinder 113, i.e., the sliding direction of drawing 3 , and stops in two locations of a processing position and an evacuation location.

[0027] One pair of fixed side rollers 115 prepare predetermined spacing in the perpendicular direction, and are being fixed to the frame 114, and the shaft 116 for bending is established possible [ rotation ] focusing on the horizontal axis between this fixed side roller 115 ( drawing 4 ). As shown in the shaft 116 for bending at drawing 4 , the rotation side [ one pair ] roller 117 is formed on the periphery of predetermined radii from the rotation center. Rotation actuation of the shaft 116 for bending is carried out a core [ a horizontal axis ] by the splash actuator 118.

[0028] The wire rod level adjustment apparatus 121 is formed in the coil former 81 side rather than S bending apparatus 111, and on the support base 122 which adhered to the frame 101, as the level guide idler 123 serves as predetermined height from a bench 30, it is being fixed. Moreover, the arm end roller 126 supported possible [ rise and fall in the perpendicular direction ] through the horizontal arm 125 by the rise-and-fall cylinder 124 prepared in the side of the level guide idler 123, i.e., the upper part in drawing 3 , is formed. This arm end roller 126 regulates an upper limit location in case a wire rod W1 and W2 pass. Besides, a limit position

can be changed by going up and down the arm end roller 126 in the rise-and-fall cylinder 124. [0029] It is equipped with two supply drums 20 on the turntable 54 of the supply apparatus 40 like drawing 1 and drawing 2 in the bobbin machine constituted as mentioned above. While it is pulled out, respectively, pass the horizontal position detection apparatus 61, it passes along the pre-processing apparatus 100 further, two are mixed by the vertical guide idler 127 and the wire rod W1 currently wound around the supply drum 20 and W2 are rolled round by the coil former 81 of a coil winding machine 70, the winding wire 25 of a predetermined configuration is manufactured.

[0030] Next, an action is explained. First, drawing 6 and drawing 7 explain the action of the supply apparatus 40. The wire rod W which carries out wearing anchoring of the supply drum 20 at a turntable 54, rotates the ramp screw thread 46 by the ramp motor 45, adjusts the height of a ramp 44, and is pulled out from the supply drum 20 passes almost horizontally the horizontal position detection apparatus 61 and the pre-processing apparatus 100. It is made to be rolled round by coil former 81 in the direction of the arrow head R of drawing 9.

[0031] In connection with pulling out a wire rod W from the supply drum 20, the drawer location of the wire rod W on the supply drum 20 is changed to a sliding direction like drawing 6 or drawing 7. That is, although the path line of a wire rod W is changed to a sliding direction, the sensor 64 of one pair of upper and lower sides follows in footsteps of a wire rod W, and goes up and down it.

[0032] If the location of the wire rod W pulled out becomes a lower part from a shaft 62, a sensor 64 will be pulled, it will fall below and the rotary arm 63 will rotate to the counterclockwise rotation in drawing 6 centering on a shaft 62, and this and the sensor 66 which counters become close. If a sensor 66 operates, a ramp 44 will drive to a rising direction like the arrow head J of drawing 6 by the ramp motor 45, and a wire rod W will serve as a horizontal position mostly. As a result, a sensor 66 serves as OFF, a sensor 65 serves as close, and lifting of a ramp 44 stops.

[0033] On the contrary, if the drawer location of a wire rod W becomes the upper part rather than a shaft 62 like drawing 7, the sensor 67 by which the rotary arm 63 rotates clockwise and counters with this will serve as close, the ramp motor 45 operates, and a ramp 44 descends in the direction of arrow-head K. And if the position of a wire rod W returns almost horizontally, a sensor 67 will serve as OFF, a sensor 65 will serve as close, and lowering of a ramp 44 will stop. You follow in footsteps of change of the location of the wire rod W with which the rise-and-fall apparatus 41 is pulled out from the supply drum 20 as mentioned above, and make it go up and down a ramp 44, and the path line of a wire rod W is maintained almost horizontally.

[0034] Moreover, the turntable 54 is connected with the rotation motor 56 through the powder clutch 55. The rotation motor 56 gives the torque of that a wire rod W is pulled out from the

supply drum 20, and a reverse direction, i.e., the torque of the rewinding direction, to the supply drum 20, and gives the back tension which is predetermined rolling-up tension to the wire rod W pulled out. Therefore, the brake 21 in drawing 13 is unnecessary like the conventional apparatus.

[0035] The magnitude of the back tension which should be given at this time is controlled as follows. First, a roller 59 is made to contact the perimeter of the wire rod W currently wound around the supply drum 20, the revolution variation-rate detector 60 detects a rotation variation rate of an actuator 57, and it asks for the outside diameter of the wire rod W wound around the supply drum 20. The rolling-up torque which should be given to the supply drum 20 based on this outside diameter and the back tension which should be given is determined, and the transmitting torque of the powder clutch 55 is controlled to give that rolling-up torque.

[0036] When it is necessary to rewind the wire rod W once sent out from the supply drum 20 to the supply drum 20 for a certain Reason, counterrotation of the turntable 54 is carried out giving predetermined rewinding tension as follows to a wire rod W. That is, the powder clutch 55 is controlled to compute the rewinding torque which was beforehand determined as the wound diameter of the wire rod W of the supply drum 20 detected with the revolution variation-rate detector 60 and which should be rewound and should be given to the supply drum 20 from tension, and to give this torque. At this time, the counterrotation rate of coil former 81 is controlled by the coil former drive unit 78.

[0037] Two the wire rod W1 and W2 which were pulled out from the supply drum 20 are put in block almost horizontally through the pre-processing apparatus 100, and they are rolled round by coil former 81. Drawing 9 - drawing 11 explain this further. It is a sectional view in part and drawing 11 is the expanded sectional view in cross-sectional XI-XI of drawing 9 which showed the condition of forming winding wire 25 while drawing 9 rolled round the wire rod W to coil former 81, and drawing 10 cut the right half of the center line S of 81 copies of this coil former, and was shown.

[0038] This winding wire 25 is what forms two or more disc-like section coils 25a continuously one after another. For example, the section coil 25a of the bottom stage winds the wire rod W1 and W2 which put two together so that a wire rod W1 might be located outside and a wire rod W2 might be located inside (refer to drawing 1) two or more times so that it may overlap on coil former 81 at the radial direction of coil former, and it forms the disc-like section coil 25a.

[0039] Then, although the 2nd step of section coil 25a is formed, you have to wind a wire rod W1 and W2 toward an inner side from an outside, without cutting a wire rod W. For this reason, as known well [ bottom / the 2nd step of section coil 25a ] The formal section coil 25a which took winding and it into pieces to disc-like, made the section coil inside-and-outside reverse temporarily, twisted toward an inner side to the outside on coil former 81, and was wound in piles toward the inner side from the outside is formed. The formal section coil 25a

which wound around the inner side and was piled up from the outside and the outside is hereafter number[ of appointed numbers ]-formed from an inner side similarly.

[0040] After winding of the section coil 25a mixes the wire rod W1 and W2 which were pulled out from the supply drum 20 with the vertical guide idler 127 of the pre-processing apparatus 100, it is wound around coil former 81. Coil former 81 is laid in the rotary table 79, and forms the disc-like section coil 25a by rotating the rotary table 79 with a servo-motor 80. At this time, the torque given to the supply drum 20 through a turntable 54 with the powder clutch 55 so that the tension of the wire rod W wound around coil former 81 may become fixed is controlled.

[0041] Moreover, prescribed dimension lowering of the ramp 77 is carried out for the section coil 25a stair-like through the rise-and-fall screw thread 74 with 1 section winding-up \*\*\*\*\* by the rise-and-fall motor 76, and the next section is rolled. Positioning of this lowering is performed by detecting the height of the rotary table 79 with an encoder 75. The path line of the wire rod W which is pulled out from the supply drum 20 by this, and is wound around coil former 81 is maintained almost horizontally. Therefore, the height of the vehicle zone which forms the section coil 25a on coil former 81 is controlled so that an activity becomes the same as the quantity of the bench set up.

[0042] At this time, in order that a wire rod W may include the section coil 25a which adjoins from the section coil 25a of 1, as for the section coil 25a, an outside-diameter side reaches most, and the passage part 25b outside a section and the passage part 25c in a section are most formed in the bore side. This is later mentioned for details, although processed by the pre-processing apparatus 100. In addition, between each section coil 25a, two or more short fence-like spacers 25d are radiately inserted like drawing 9 in the predetermined part on the periphery.

[0043] Moreover, winding wire 25 is performing what is called dislocation that replaces the bore and outside-diameter side mutually for two wire rods in the passage part 25b outside a section, or the passage part 25c in a section, in order to control circulating current. After dislocation used the stencil etc. for every section coil, united the processing position with S bending and carried out marking on the periphery of winding wire conventionally, the hand tool was performing, but the pre-processing apparatus 100 can perform this dislocation. This is also mentioned later for details.

[0044] S bending point front-processed as follows is controlling by the form of this operation to come to the predetermined include-angle location alpha on winding wire ( drawing 9 ). That is, the rolling-up tension of the wire rod W rolled round by coil former 81 from the supply drum 20 is controlled by the powder clutch 55 to a predetermined value. Moreover, since the physical relationship of a coil winding machine 70 and the pre-processing apparatus 100 is constant, include-angle deduction control is performed with a servo-motor 81 about the rotary table 79. That is, it can control so that the appointed include angle alpha and the engine speed N of the

rotary table 79 become a predetermined value, and it can guide so that S bending point may come to the predetermined location on winding wire correctly.

[0045] It returns to drawing 3 and drawing 4, and S bending which is pre-processing of the wire rod W by a pre-processing apparatus is explained. The wire rod W1 and W2 which were pulled out from the supply drum 20 are maintained at an almost level position by the level roller 103 adjusted to the same height as a shaft 62 (drawing 1). Moreover, the location on a wire rod W1 and the level surface of W2 is regulated, respectively with the vertical roller 104,105 formed before and after S bending apparatus 111.

[0046] The lower limit of the perpendicular direction is restricted by the level guide idler 123, and, as for each wire rod W1 and W2 which came out of the vertical roller 105, an upper limit is restricted by the vertical guide idler 127. Moreover, it is collected together in the form extracted with the vertical guide idler 127 into the level surface, and is rolled round to coil former 81. In addition, a wire rod W1 and W2 are usually supported to the level guide idler 123, the wire rod W1 and W2 which were pulled out from the supply drum 20 are supported to the level roller 103 and the level guide idler 123, maintain a horizontal position mostly, and they are rolled round by coil former 81.

[0047] If the section coil 25a of 1 is formed, in order to wind the adjoining section coil 25a, S bending is performed so that the passage part 25b outside a section and the passage part 25c in a section may come to the degree location of prescribed angle on the periphery on winding wire (refer to drawing 10 and drawing 11), when a wire rod W is rolled round. The location which should prepare S bending point in before \*\* on the basis of the present revolution location of the rotary table 79 is determined.

[0048] A wire rod W1 and W2 are on the path line which is regulated in the location of the perpendicular direction with the revolution variation-rate detector 60, the level roller 103, and the level guide idler 123, and is regulated with the vertical roller 104,105 and the vertical guide idler 127 in a horizontal location. At the time of S bending, a frame 114 drives the infestation guide 112 top to the sliding direction of drawing 3, i.e., the horizontal direction of drawing 5, in the actuation cylinder 113, and moves onto the path line of W2 from an evacuation location to [W1] a processing position (i.e., a wire rod). Drawing 5 shows the condition that the frame 114 of the method of the right is in S bending location of a wire rod W1, and the left frame 114 is in an evacuation location.

[0049] At this time, the rotation side [ two pieces ] roller 117 attached to the shaft 116 for bending is in the location which overlaps in the perpendicular direction like drawing 8, and has a wire rod W1 and spacing with sufficient W2. A frame 114 is moved to a predetermined location, i.e., a path line, it inserts between a wire rod W1 and the rotation side roller 117 in which W2 were prepared by each shaft 116 for bending, and the counterclockwise rotation in drawing 4 is made to rotate the shaft 116 for bending with the splash actuator 118.

[0050] Then, as shown in drawing 4, it is inserted between the left fixed side roller 115 and the left rotation side roller 117 and between the rotation side roller 117 of the method of the right, and the fixed side roller 115 of the method of the right, and plastic deformation of a wire rod W1 or the wire rod W2 is carried out. The passage part 25b outside a section which became a prescribed dimension stage difference, or the passage part 25c in a section is formed in a sliding direction. Then, as the shaft 116 for bending is counterclockwise returned with the splash actuator 118 and the rotation side roller 117 separates from a wire rod W like drawing 8, since, a frame 114 is retreated to an evacuation location in the actuation cylinder 113. Such an action is performed and S bending is ended.

[0051] Next, the action of the wire rod level adjustment apparatus 121 is explained. Like drawing 9, it is united by the vertical guide idler 127, and is unified, and a wire rod W1 and W2 are wound around coil former 81. It is because effectiveness of the level guide idler 123 which regulates the height with more nearly horizontal unifying which united a wire rod W1 and W2 with the vertical guide idler 127 is good.

[0052] In addition, in the condition of not having transposed, the height is regulated with the level roller 103, the level guide idler 123, and the arm end roller 126, and the wire rod W1 and W2 which pass S bending apparatus 111 pass horizontally. Moreover, when the passage part 25b outside a section which was carried out as for S bending, and the passage part 25c in a section pass, the arm end roller 126 is moved upwards and it is made to pass in the rise-and-fall cylinder 124 like drawing 4.

[0053] As stated also in advance, when crossing to the following section coil from one section coil When [ namely, ] performing dislocation which replaces the wire rod W1, bore [ as opposed to coil former for W2 ], and outside-diameter side the cut water of a section coil, or after winding and performing S bending in the last part since it will not become if there is no location exchange on the level surface of a wire rod W1 and a wire rod W2 like drawing 9, the height of the level roller 103 by the side of a wire rod W2 ( drawing 12 the left side) is made high in a cylinder 102, and it is made for a wire rod W2 to cross in the upper part of a wire rod W1

[0054] In addition, the condition that the wire rod W1 and the wire rod W2 crossed in the perpendicular direction by such dislocation, and the path line leans for a while in this invention is also included. It is expressing that the wire rod which passes a pre-processing apparatus from a supply drum, and is rolled round by coil former becomes almost level between a supply drum and coil former.

[0055] After removing a wire rod W1 and W2 from the vertical roller 104,105 and the vertical guide idler 127 and replacing the location of the upper and lower sides in a wire rod W1 and drawing 3 of W2 for replacing a wire rod W1 and a wire rod W2, it puts into the vertical roller 104,105 and the vertical guide idler 127, and changes into the condition of drawing 9. In

addition, the cylinder 102, the level roller 103, the vertical roller 104,105, and the wire rod level adjustment apparatus 121 constitute the guide apparatus in this invention.

[0056] Rolling up of a wire rod W or rewinding to the supply drum 20 can be performed keeping almost constant a wire rod W1 and the path line of W2, and giving predetermined tension with the combination of the above supply apparatus 40 and coil winding machines 70. Moreover, the rotation motor 56 can be stopped where brakes are applied, and a back tension in case the associative strength of the powder clutch 55 is controlled, a brake force is given to the supply drum 20 and a wire rod W is rolled round by coil former 81 can also be adjusted.

[0057] Moreover, instead of giving a braking force with the powder clutch 55, the brake which brakes a main shaft 52 directly, for example may be prepared, and the flange of the supply drum 20 laid in the turntable 54 etc. may be braked directly. You may drive the flange of the supply drum 20 etc. directly similarly about the approach of giving rewinding tension. In addition, a drum rise-and-fall apparatus is formed on a turntable 54, and it can go up and down a supply drum.

[0058] Since it rolls round to coil former 81 and winding wire was formed, keeping the path line of a wire rod W almost level as mentioned above, formation of the section coil 25a was attained without an operator adding a hand to a wire rod W1 and W2. In addition, the section coil 25a was rolled, adjusting delicately, as conventionally overlapped in a wire rod W1 and W2 on a concentric circle by considering one's hand as a guide at the locality equivalent to the wire rod level adjustment apparatus 121.

[0059] Since it bends even if it makes small distance of the supply drum 20 and coil former 81, and a peculiarity does not stick, an establishment tooth space can be made small.

Furthermore, since braking torque is applied and rolled round to the supply drum 20 and tension is generated, there is also no possibility of damaging a wire rod, especially the paper-covered-wire material around which the paper insulation tape was wound. Moreover, since it rolls back giving predetermined rewinding tension, when there is no possibility that a wire rod may bend and change at the time of rewinding and it rolls round again, the location of a wire rod does not shift.

[0060] With S bending apparatus 111, when crossing to the following section coil from the section coil of 1, bending for passages into which only the passage cost processes a wire rod in a completely different class can be performed. Moreover, by changing the height of the level roller 103 of S bending apparatus 111, the mutual location is replaced for dislocation of the wire rod \*\*\*\*\*\*(ed) by two or more supply drums, and coil former 81 can be supplied.

[0061] Furthermore, in S bending apparatus 111, set a double shaft as the shaft 116 for bending, and on an inside shaft [ the rotation side roller 117 ] It is also possible by attaching the roller equivalent to the above-mentioned fixed side roller 115 to an outside shaft, and adjusting the rotation angle of these double shafts to it to enable it to select arbitrarily the

dimension of S bending made in a completely different class.

[0062] In addition, since the action of the location of S bending point makes it possible to always impose a back tension on a wire rod W1 and W2, beforehand, a wire rod W is rolled, and it goes to S bending point on the periphery of winding wire, and performs marking to a wire rod W. Then, it can rewind by predetermined tension with the supply apparatus 40, if the marking point concerned comes to the predetermined location of S bending apparatus 111, it can be made to be able to stop, and S bending can also be performed.

[0063] Since it can read also as an include-angle location of the rotary table 79, after forming a control device with teaching performance and making location data memorize, teaching location data can also be taken out and used for the halting point when winding each section coil 25a. Since it rolls back giving predetermined rewinding tension especially in this case, when a wire rod bends, and it changes, or an elongation percentage changes and it rolls round again, there are not a location of a wire rod and a possibility that especially S bending point may shift.

[0064] As mentioned above, according to this bobbin machine, working capacity improves by mechanization of a winding wire activity. Since an opportunity to touch a wire rod at the time of a winding wire activity decreases, the safety of an activity also improves. Moreover, even if it is not a skillful operator, a winding wire activity can be performed, and the quality of winding wire is also stabilized.

[0065] The form of operation of form 2. above-mentioned drawing 1 of operation showed the thing which should fix the height of the bench 30 to fixed height from Floor F, and makes it go up and down both the turntable 54 and the rotary table 79. However, it can also be performed as follows, for example. The coil former rise-and-fall apparatus 71 of a coil winding machine 70 is excluded, and coil former 81 is supported possible [ rotation ] from Floor F at the place of predetermined height. And you make it go up and down the supply drum 20 and a bench 30 to compensate for winding wire 25 being formed on coil former 81, and a rolling-up location changing, and the wire rod W between the supply drum 20 and coil former 81 maintains a horizontal position mostly.

[0066] In addition, since the level position of the wire rod W between the supply drum 20 and coil former 81 can be maintained even if you make it go up and down either among the supply drum 20 and coil former 81 when the pre-processing apparatus 100 does not need to be formed, you may form either the rise-and-fall apparatus 41 or the coil former rise-and-fall apparatus 71.

[0067] Although what rewinds to the supply drum 20 with the powder clutch 55 of the drum drive unit 51, and gives the tension and the braking force at the time was shown, a motor with eddy current distributor shaft coupling can also be used instead of the powder clutch 55. Moreover, although the wire rod showed the thing which has parallel two and which is supplied

from two supply drums 20, even if the parallel number of a wire rod changes, it cannot be overemphasized that it can do similarly.

[0068]

[Effect of the Invention] Since this invention is constituted as explained above, it does so effectiveness which is indicated below. So that predetermined rolling-up tension may be given to the turntable in which the supply drum around which the revolution in right reverse both directions was enabled focusing on the vertical axis, and the wire rod was wound is laid, and the wire rod pulled out from a supply drum The supply apparatus which has the rewinding apparatus which renews the wire rod which the reverse direction was made to rotate the braking system and supply drum which brake a revolution of a supply drum, and was once sent out to a supply drum while giving predetermined rewinding tension, The coil winding machine which has the coil former which rolls round a wire rod from a supply drum and forms winding wire while rotating focusing on a vertical axis, And since it should have at least one side of the drum rise-and-fall apparatus which goes up and down a supply drum, and the coil former rise-and-fall apparatus which goes up and down coil former so that the wire rod rolled round by coil former might become almost level from a supply drum between a supply drum and coil former The wire rod rolled round by coil former becomes almost level from a supply drum between a supply drum and coil former, a bending peculiarity does not arise, distance of a supply drum and a heart type is shortened, and an establishment tooth space can be made small. Moreover, since predetermined rolling-up tension is given to the wire rod which brakes a supply drum with a braking system and is pulled out from a supply drum, there is no possibility of damaging a wire rod, especially the wire rod by which the paper streamer volume insulation was carried out. Furthermore, since the once sent-out wire rod is rewound giving predetermined rewinding tension, the deviation of the wire rod when not slackening and changing during rewinding and rolling round again can be prevented.

[0069] and [ coil former ] so that a wire rod may go across a wire rod from the disc-like coil section of 1 which winds around the radial direction of coil former in piles, and is formed in it, and the coil section of 1 It is what carries out, and adjoins the coil section of 1, rolls round so that another disc-like coil section which wound around the radial direction of coil former in piles, and was formed in it may be formed, and forms winding wire. While forming the pre-processing apparatus which performs bending for passages so that it can cross to another coil section into which a wire rod adjoins from the coil section of 1 between a supply apparatus and a coil winding machine Form both drum rise-and-fall apparatus and coil former rise-and-fall apparatus, or a pre-processing apparatus rise-and-fall means of a drum rise-and-fall apparatus and a coil former rise-and-fall apparatus to reach on the other hand at least, and to go up and down a pre-processing apparatus is established. Since it is characterized by enabling it to level mostly the wire rod which passes a pre-processing apparatus from a supply drum, and is rolled

round by coil former between a supply drum and coil former Mechanization of passage processing crossed to another coil section which adjoins from the coil section of 1 with a pre-processing apparatus can be performed, and working capacity can be raised.

[0070] Furthermore, after determining the location on the wire rod which the pre-processing apparatus should once form a disc-like coil section, and should prepare the bending part for passages, Since it is characterized by being what can carry out bending for passages to the location on a prescribed length rewinding wire rod with a rewinding apparatus Without a wire rod slackening and changing at the time of rewinding, since it rewinds by predetermined tension, when bending for passages is carried out and it rolls round again, there is also no possibility that the location of the bending part for passages may shift, and the quality of winding wire can be improved.

[0071] [ moreover, a braking system ] Since it is characterized by being what rolls round by giving the braking torque for which it asked from the predetermined rolling-up tension which should be given to a wire rod, and the diameter of a volume of the wire rod currently wound around the supply drum to a turntable, and controls tension to a predetermined value when rolling round from a supply drum to coil former Since braking torque is given and rolled round on a turntable and tension is made into a predetermined value, there is no possibility of damaging a wire rod and the dependability of an insulation of winding wire can be improved.

[0072] [ and a rewinding apparatus ] Since it is characterized by being what rewinds by [ which asked from the predetermined rewinding tension which should be given to a wire rod, and the diameter of a volume of the wire rod currently wound around the supply drum ] rewinding and giving torque to a turntable, and controls tension to a predetermined value when rewinding a wire rod to a supply drum Without a wire rod slackening and changing by rewinding by predetermined rewinding tension at the time of rewinding, when bending for passages is carried out and it rolls round again, there is also no possibility that the location of the bending part for passages may shift, and the quality of winding wire improves.

[0073] Furthermore, as for a supply apparatus, a turntable can also receive plurality. Since it is characterized by forming the guide apparatus which replaces and guides a location in the direction of rolling up of a wire rod, and the right-angled direction in order to perform dislocation which replaces the mutual location of the radial direction to the coil former when rolling round each wire rod from the supply drum laid in the pre-processing apparatus by each turntable to coil former As a mutual location is replaced in the direction of a wire rod's rolling up of the wire rod from two or more supply drums, and the right-angled direction and it can transpose, improvement in efficiency of a winding wire activity can be aimed at.

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[Translation done.]